

## Cabinet for the storage of goods requiring refrigeration

### Field of the Invention

The invention relates to a cabinet for the storage of goods requiring refrigeration, consisting of a modular frame structure, space-delimiting elements and shelves bearing the goods.

### Background of the Invention

Cabinet systems used in food trade for presentation of the goods in the sales area are either non-refrigerated or refrigerated cabinet systems depending on the goods ever.

10 Non-refrigerated cabinets, made usually of galvanized sintered steel plates, are typically structured in a modular way, that is, thanks to their structural design, they can be assembled on the spot, out of "elements" of a smaller size, in function of the demands ever of the user and the possibilities offered by the premises.

In case of modular cabinets, users can assert their claims regarding the length and  
15 height of the cabinet, the size and design, loading capacity and fittings of the base shelf and the middle shelves, which can be assembled, upon demand, either as one-sided or as symmetrical, twin frames, as is most expedient for displaying of the goods to be stored on them. The module system and the uniform size dimensions allow the various manufacturers to offer their cabinet systems with different options and hence  
20 an extensive array of accessories and complementary elements. It is a highly important and advantageous property of the said cabinets that they can be disassembled and transformed. Their assembly requires no special expertise or skills, and they are transported to the target location in detached form, in pieces. It is a further advantage that they cannot only be built up in a straight line but, thanks to the existing accessories, in  
25 an angle, usually of 45° or 90°, also, and hence along diverse cabinets matching the layout of the sales premises ever, to ensure optimum space utilization, making it quite easy to install cabinets around pillars in the outlet, too. Such non-refrigerated cabinets as outlined above are manufactured and distributed by the German Tegometall Ladenbau GmbH (see the product catalogue of the company for 2002, Postfach 1273, D-  
30 72502, Krauchenwies).

Refrigerating cabinets are pieces of ready-built furniture manufactured according to the demand ever, transported to the place of use – where only their caloric heat exchanger and electronic units are to be connected to supply sources installed beforehand – in assembled form, ready for operation. Refrigerating wall cabinets, used mainly for the purpose of storing milk and dairy goods, meat and deep-frozen food goods, are typically of a robust design and include an insulated refrigerating furniture body set in a rigid steel frame. The insulation is usually a two-component, high-density polyurethane foam introduced between two steel plates, which forms a sandwich-type panel element of some sort with the latter after solidification. This is the insulated frame of the refrigerating cabinet, and the electrical units and caloric heat exchanger parts are built into this furniture body. The cabinet system used for storing goods is also incorporated into this ready-built frame structure. Systems similar to the refrigerating cabinet outlined above are manufactured and distributed as “RP Standard refrigerated wall cabinets” by the Austrian Hauser Kühlanlagen GmbH (A-4040 Linz, Am Hartmayrgut 4-6). A piece of ready-built refrigerating cabinet is a massive unit that cannot be disassembled into its units after manufacture. Of course, it is possible to manufacture this, too, in non-standard sizes, to design elements broken in some angle or corner elements, but the relevant manufacturing costs often exceed the production cost of refrigerating furniture pieces manufactured in standard sizes.

In summary of the above, it is easy to understand that there exists a significant demand for such cabinets suitable for storing goods requiring refrigeration as can be constructed, similarly to the current non-refrigerating cabinets, in a modular way, and modified or disassembled if necessary and, moreover, that offer good portability and on-the-spot assembly features adjusted or adjustable to the specific circumstances of utilization, without the usual disadvantage of refrigerated cabinets, viz. fixed size, as ordered, impossible to alter later on, often making it necessary to replace the entire furniture set in case of a change in size or location.

#### Summary of the Invention

Our solution of the target objective relies on a cabinet for the storage of goods requiring refrigeration having a modular assembled frame structure, space-delimiting ele-

ments and shelves supporting the goods. According to the present invention, said cabinet is equipped with a caloric heat exchanger means generating an air flow of a temperature selected to suit the goods, and an air channel system communicating with it.

According to a preferred embodiment of the proposed cabinet, the caloric heat exchanger means includes an air inlet, an evaporator, a fan and an air outlet.

According to another preferred embodiment of the proposed cabinet, the walls of the air channel system consist in part of the frame structure and space-delimiting elements of the said cabinet.

In yet another preferred embodiment of the proposed cabinet, the walls of the air channel system are at least partly heat-insulated. In this case, the implementation whereas the entire air channel system is made of heat-insulating plates shall also be regarded as advantageous.

It is preferred furthermore, that the heat exchanger means and air channel system of the cabinet be designed as a single unit attachable to the assembled cabinet.

According to another preferred embodiment of the proposed cabinet, the caloric heat exchanger means generating the air stream is arranged under the lowest shelf of the cabinet, and the air channel system communicating with it is located deep-set behind the frame structure of the cabinet.

According to another preferred embodiment of the present invention, the caloric heat exchanger means generating the air stream is built into the upper space-delimiting element of the cabinet, and the air channel system communicating with it is located deep-set behind the frame structure of the cabinet.

According to a further preferred embodiment of the present invention, the caloric heat exchanger means of the cabinet is associated with a condensing unit requiring power supply only, that is arranged on the cabinet, thermally insulated from the caloric heat exchanger means.

#### Brief Description of the Drawings

The invention is described more detailed with reference to the accompanying draw-

ings, in which

- Figure 1 provides an perspective view of the frame structure, space-delimiting elements and shelves of a non-refrigerated cabinet;
- Figure 2 shows the cabinet according to Figure 1 in rear view;
- 5 Figure 3 indicates a possible implementation of the caloric heat exchanger means of the cabinet according to the present invention;
- Figure 4 shows a possible implementation of the house incorporating the caloric heat exchanger means according to Figure 3;
- Figure 5 shows the house according to Figure 4, partly fitted to its place in the  
10 cabinet according to Figure 1;
- Figure 6 shows a possible embodiment of combining the air channel system and the house, in the course of the air channel system being superimposed onto the house;
- Figure 7 shows the air channel system, almost fitted onto the house, according  
15 to Figure 6;
- Figure 8 shows the cabinet including the caloric heat exchanger means fitted to its final place, partly in rear view;
- Figure 9 shows a cross-section of a possible embodiment of the caloric heat exchanger means and the air channel system designed as a single unit,  
20 installed already;
- Figure 10 shows a caloric heat exchanger means placed in the upper part of the cabinet;
- Figure 11 shows the schematic cross-section of a two-sided (twin) refrigerated cabinet joined back to back and
- 25 Figure 12 is the schematic cross-section of a cabinet according to the present invention, supplemented with a separate condensing unit.

### Detailed Description of the Preferred Embodiment

Figure 1 shows the frame structure and space-delimiting elements of a well-known, extensively manufactured and distributed non-refrigerated cabinet type. The frame structure consists of two column elements 1 whose vertical size essentially determines the height of the cabinet, with two horizontal foot elements 2 attached to the lower end of the column elements 1. The length of the horizontal foot elements 2 determines the depth of the cabinet to be made, that is, the depth of the shelves on the cabinet. Legs 3 are fitted to the ends of each column element 1 and foot element 2. The legs 3 are optionally designed as screwed paw to regulate height, or one designed as a wheel or fitted with a wheel to allow to move of the cabinet. Column elements 1 are usually made of a hollow, preferably rectangular section or a U-shaped bar, provided with openings in one row or in two rows into which other parts constituting the cabinet can be fixed by hanging in order to allow a modular arrangement. Accordingly, on Figure 1, between the two column elements 1, back panels 4 are inserted vertically, whose length determines the width of the finished cabinet. Back panels 4 can be solid or perforated to promote the airing of goods placed in the cabinet. Base shelf 5 is fitted on foot elements 2, with another two shelves 6 arranged on consoles fixed by hanging on column elements 1 above it. Mainly for aesthetic reasons, between legs 3 of foot elements 2 a cover 7 is placed, attached to a base shelf 5. Owing to its design, the finished cabinet, assembled this way, can be used as a wall cabinet.

Figure 2 shows the cabinet in Figure 1 in rear view. As can be seen, under base shelf 5 and between column elements 1, there is sufficient space to ensure the circulation of air of a temperature determined by appropriate technical measures.

In order to transform the traditional non-refrigerated cabinet shown in Figures 1 and 2 into the refrigerated cabinet according to the invention, a heat exchanger means 8 is built into the cabinet, providing air of the temperature desirable for the goods placed on the cabinet or, more precisely, on base shelf 5 and shelves 6. This caloric heat exchanger means 8 can be designed for example according to the method outlined in Figure 3, and it can be placed in a housing 9 as shown in Figure 4. Housing 9 of heat exchanger means 8 has an air inlet 10, coinciding, in operating position, with internal

opening 11 in base shelf 5, in the given case, preferably along almost its entire length. Housing 9 may include heat insulation 12, but in the given case, material of sufficient heat insulating capacity as the material of housing 9 can be used, hence, for example, housing 9 can be made entirely of polyurethane foam. Behind air inlet 10 – considering the flow direction of the generated air stream – a heat exchanger 13, in the given case a lamellar evaporator is positioned, connected in a way that is not shown in the drawing, to the cooling medium source created in the premises in advance. Below heat exchanger 13, an outlet 14 is formed to allow to dispose of humidity/liquids having entered housing 9 or generated there, and behind heat exchanger 13, there is a fan 15 connected to an air outlet 16 of the housing 9. The internal space of housing 9 is closed from above by a metal cover plate omitted from the drawings, which provides complementary cooling to base shelf 5 positioned right above it and to the goods stored there. Heat exchanger means 8 includes, as a matter of course, in addition to the units indicated in the drawing, the supply valve necessary for introducing the cooling medium, other control and safety elements, and owing to its design presented here, it conducts cold air onto the goods to be refrigerated, more precisely, it creates and maintains a continuous air curtain between the external space and the internal refrigerated space of the cabinet.

Caloric heat exchanger means 8 can be placed as shown in the cross-section on Figure 9, under base shelf 5 of the cabinet, or in the uppermost part of the non-refrigerated cabinet (see Figure 10). It can be ensured in both cases that the installation of caloric heat exchanger means 8 shall not alter the structure of the cabinet, and hence heat exchanger means 8 can be ordered as optional accessory at will, and it can be mounted onto or dismounted from the cabinet at any time.

The air flows into caloric heat exchanger means 8 through air inlet 10, to go through the lamellar heat exchanger 13 and be cooled subsequently, and to leave the heat exchanger means 8 through air outlet 16, driven by fan 15, and to enter into a preferably insulated air channel system 17 to be presented below.

In the case of housing 9 shown in Figure 4, air outlet 16 of the caloric heat exchanger means 8 is not positioned in the same plane as the air inlet 10, but it rises higher, like a

chimney. The explanation for that is that, putting housing 9 including heat exchanger means 8 into working position, that is, pushing it into the space defined by column elements 1, consoles 2 and cover 7 of the cabinet, air outlet 16 will be positioned in between column elements 1, behind back plane elements 4. This operation is shown in

5 Figure 5. At this point, as it is clear for a person skilled in the art, it is possible to form an air channel system 17, preferably an insulated one, in several ways, so that the said channel, communicating with caloric heat exchanger means 8, shall direct cooled air exiting the latter to the top of the cabinet, and conduct it to the goods stored on shelves

10 6. This air will then proceed downwards along the front plane of the cabinet, in front of shelves 6, as an air curtain, to re-enter subsequently, through air inlet 10 of the heat exchanger means 8, housing 9 of heat exchanger means 8. Air channel system 17 is preferably provided with insulation on the back side of the cabinet and on the sides of its column elements 1, and according to a preferred embodiment, it is perforated on its side to back panels 4, and hence it ensures, similarly to the traditional cabinets, the free

15 flow of air outwards, towards the open product space to be refrigerated. Heat-insulated air channel system 17 is directly connected to caloric heat exchanger means 8 placed under the base shelf 5. This may happen in the manner shown in Figures 6 and 7, that is, air channel system 17 may be shrouded onto caloric heat exchanger means 8, and then the entire structure be pulled under and behind the cabinet. Air drawn and cooled

20 via heat exchanger means 8 enters through air channel system 17 built in between column elements 1 to flow up to the top of the cabinet, to the upper outlet, that can be formed directly above the uppermost back plane 4 or, if the cabinet has, similarly to the display refrigeration counters designed like pieces of furniture, space-delimiting elements both on top and on its two sides (for the sake of better understanding, lateral

25 space-delimiting elements are omitted from the drawings), then it may exit through opening 18 formed in the top of the cabinet, to pass by shelves 6, continuously cooling them as well as goods stored on base shelf 5 in the meantime. Subsequently, it will enter housing 9 of heat exchanger means 8 via opening 11 on base shelf 5, whereas heat exchanger 13 of heat exchanger means 8 cools it again, and fan 15 drives the air

30 again to air channel system 17. This way, a continuous air curtain similar to that in the traditional refrigerating shelf structures can be formed between the refrigerated goods

space and the external open space.

Air channel system 17 is built in between column elements 1 from the rear, and it is fixed in a way allowing to take it out and away at any time without destruction if it is no longer necessary to operate the cabinet as refrigerated cabinet. Similarly, housing 9 of caloric heat exchanger means 8 is also installed detachably, and it can be disconnected easily from the caloric and electric supply sources of heat exchanger 13 and fan 15, respectively.

From the point of view of air circulation, it is irrelevant if, instead of being placed under base shelf 5, caloric heat exchanger means 8 is located roof-like in the upper part of the cabinet. In this case, heat exchanger means 8 will suck the air through the air channel system 17 from the lower part of the cabinet, and cool it in its upper part with the help of the heat exchanger 13, and create an air curtain by letting it flow out through air outlet 16 formed at the upper external edge of the cabinet, that will separate the inner space of the cabinet from the outer space and cool goods stored on shelves 6 and base shelf 5. This solution allows, similarly to the traditional refrigerating serve over counters, the refrigeration of goods placed on a platform. In this case, foot elements 2 and the cabinet shall be covered skirt-like at the bottom, so that air channel system 17 should circulate the air inside the cabinet.

So far an almost optimum case has been presented, with caloric heat exchanger means 8 and air channel system 17 either fitted to each other or designed as a single, integrated unit conducting the air creating the air curtain in a heat-insulated way in all directions. In simpler cases, it is also feasible to use heat insulation, instead of the complete channel-like design, only on the back surface of the cabinet, or in case of a design corresponding to column element 1, including air sealing, for a cabinet placed against the wall, air channel system 17 may also be constituted by back panels 4 of the cabinet, the wall of the room including the cabinet, and the column elements 1 as well. From the point of view of manufacture and assembly, heat exchanger means 8 and air channel system 17 realized as a single integrated structural module shall be treated as advantageous implementation, as shown in Figure 8, because the module manufactured this way, suitable for numerous cabinets owing to the modular structure, can be



coupled in a simple way with the cabinet that is to be transformed into a refrigerating-type cabinet.

Note among the main advantages of the proposed solution that it allows to create a refrigerated cabinet of a size and design chosen at will out of an existing cabinet or a mass-manufactured cabinet product range, so that the module structure of the non-refrigerated cabinet does not have to be altered, and hence the cabinet incorporates all the advantageous characteristics of the modular assembly option. The transformation implies no permanent change in structural design, in the basic parameters or external dimensions of the original cabinet, and hence it can be transformed into a non-refrigerated cabinet at any time at discretion by the replacement of certain elements and the installation and fitting of further units.

It offers the end-user a wider choice of selection and variation options thanks to its simple and serviceable implementation. The cabinet can be adjusted at any time to the needs of the user or the transformation of the premises, and if two of the presented cabinets are placed back to back, it is possible to form a twin refrigerated cabinet as shown in Figure 11.

If necessary, the proposed cabinet can also be used with an in-built condensing unit. As can be seen in Figure 12, in this case, condensing unit 19 shall be used preferably thermally separated from caloric heat exchanger means 8, and placed at the back of the cabinet or equipped with special casing, fixed on the top of it. The proposed cabinet can be altered or re-built easily and quickly later on to match the turnover ever and, thanks to its structural design, it is substantially cheaper than the traditional, ready-built refrigerating cabinets.

The description does not cover optional accessories (e.g., lighting, night shutters) and their arrangement, as these will change according to the design and module system of the chosen non-refrigerated cabinet range.